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# FAST CMOS BUFFER/CLOCK DRIVER

**IDT49FCT805/A**

## FEATURES:

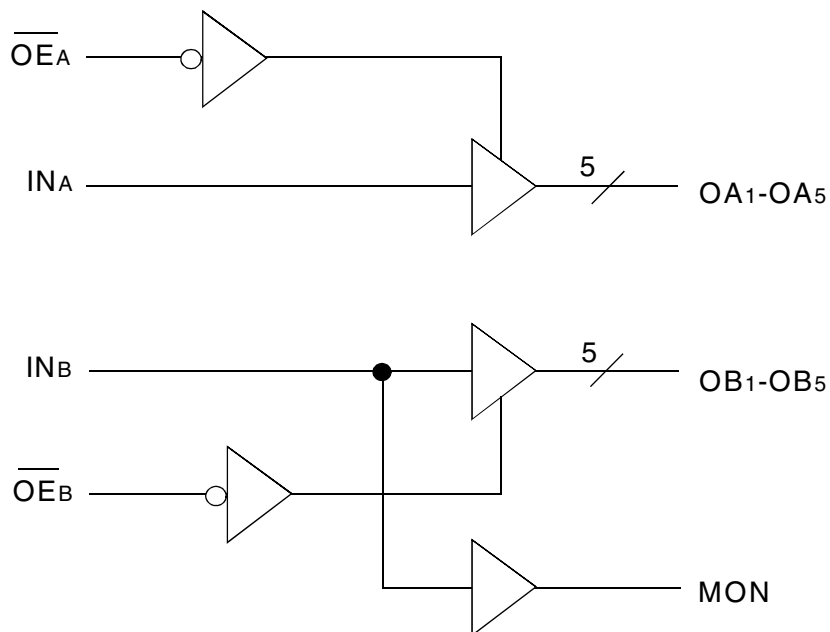
- 0.5 MICRON CMOS Technology
- Guaranteed low skew < 700ps (max.)
- Low duty cycle distortion < 1ns (max.)
- Low CMOS power levels
- TTL compatible inputs and outputs
- Rail-to-rail output voltage swing
- High drive: -24mA  $I_{OH}$ , +64mA  $I_{OL}$
- Two independent output banks with 3-state control
- 1:5 fanout per bank
- "Heartbeat" monitor output
- Available in SSOP and SOIC packages

## DESCRIPTION:

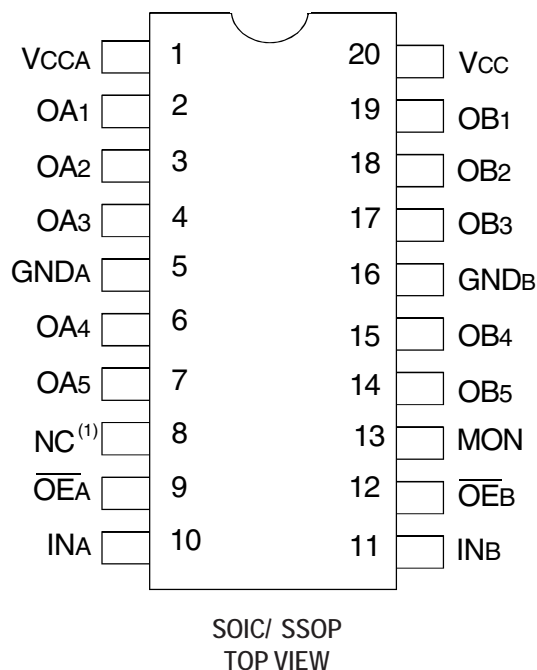
The 49FCT805 is a non-inverting buffer/clock driver built using advanced dual metal CMOS technology. Each bank consists of two banks of drivers. Each bank drives five output buffers from a standard TTL compatible input. These devices feature a "heart-beat" monitor for diagnostics and PLL driving. The MON output is identical to all other outputs and complies with the output specifications in this document.

The 49FCT805 offers low capacitance inputs and hysteresis. Rail-to-rail output swing improves noise margin and allows easy interface with CMOS inputs.

## FUNCTIONAL BLOCK DIAGRAM



### PIN CONFIGURATION



**NOTE:**

1. Pin 8 is not internally connected on devices with a "K" prefix in the date code. On older devices, pin 8 is internally connected to GND. To insure compatibility with all products, pin 8 should be connected to GND at the board level.

### ABSOLUTE MAXIMUM RATINGS(1)

Symbol	Description	Max	Unit
V <sub>TERM</sub> (2)	Terminal Voltage with Respect to GND	-0.5 to +7	V
V <sub>TERM</sub> (3)	Terminal Voltage with Respect to GND	-0.5 to V <sub>CC</sub> +0.5	V
T <sub>STG</sub>	Storage Temperature	-65 to +150	°C
I <sub>OUT</sub>	DC Output Current	-60 to +60	mA

**NOTES:**

1. Stresses greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.
2. Input and V<sub>CC</sub> terminals.
3. Output and I/O terminals.

### CAPACITANCE (T<sub>A</sub> = +25°C, f = 1.0MHz)

Symbol	Parameter(1)	Conditions	Typ.	Max.	Unit
C <sub>IN</sub>	Input Capacitance	V <sub>IN</sub> = 0V	4.5	6	pF
C <sub>OUT</sub>	Output Capacitance	V <sub>OUT</sub> = 0V	5.5	8	pF

**NOTE:**

1. This parameter is measured at characterization but not tested.

### PIN DESCRIPTION

Pin Names	Description
OE <sub>A</sub> , OE <sub>B</sub>	3-State Output Enable Inputs (Active LOW)
IN <sub>A</sub> , IN <sub>B</sub>	Clock Inputs
OA <sub>n</sub> , OB <sub>n</sub>	Clock Outputs
MON	Monitor Output

### FUNCTION TABLE (1)

Inputs		Outputs	
OE <sub>A</sub> , OE <sub>B</sub>	IN <sub>A</sub> , IN <sub>B</sub>	OA <sub>n</sub> , OB <sub>n</sub>	MON
L	L	L	L
L	H	H	H
H	L	Z	L
H	H	Z	H

**NOTE:**

1. H = HIGH  
L = LOW  
Z = High-Impedance

## DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:  $V_{LC} = 0.2V$ ;  $V_{HC} = V_{CC} - 0.2V$

Commercial:  $T_A = 0^\circ C$  to  $+70^\circ C$ , Industrial:  $T_A = -40^\circ C$  to  $+85^\circ C$ ,  $V_{CC} = 5V \pm 5\%$

Symbol	Parameter	Test Conditions <sup>(1)</sup>	Min.	Typ. <sup>(2)</sup>	Max.	Unit	
$V_{IH}$	Input HIGH Level (Input pins)	Guaranteed Logic HIGH Level	2	—	—	V	
$V_{IL}$	Input LOW Level (Input and I/O pins)	Guaranteed Logic LOW Level	—	—	0.8	V	
$I_{IH}$	Input HIGH Current	$V_{CC} = \text{Max.}$ $V_I = 5.5V$	—	—	$\pm 1$	$\mu A$	
$I_{IL}$	Input LOW Current	$V_{CC} = \text{Max.}$ $V_I = \text{GND}$	—	—	$\pm 1$	$\mu A$	
$I_{OZH}$	Off State (Hi-Z) Output Current	$V_{CC} = \text{Max.}$ $V_O = V_{CC}$	—	—	$\pm 1$	$\mu A$	
$I_{OZL}$			—	—	$\pm 1$		
$V_{IK}$	Clamp Diode Voltage	$V_{CC} = \text{Min.}$ , $I_{IN} = -18mA$	—	-0.7	-1.2	V	
$I_{OS}$	Short Circuit Current	$V_{CC} = \text{Max.}$ , $V_O = \text{GND}^{(3)}$	-60	-120	—	mA	
$V_{OH}$	Output HIGH Voltage	$V_{CC} = 3V$ , $V_{IN} = V_{LC}$ or $V_{HC}$	$I_{OH} = -32\mu A$	$V_{HC}$	$V_{CC}$	—	V
		$V_{CC} = \text{Min.}$	$I_{OH} = -300\mu A$	$V_{HC}$	$V_{CC}$	—	
		$V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OH} = -15mA$	3.6	4.3	—	
			$I_{OH} = -24mA$	2.4	3.8	—	
$V_{OL}$	Output LOW Voltage	$V_{CC} = 3V$ , $V_{IN} = V_{LC}$ or $V_{HC}$	$I_{OL} = 300\mu A$	—	GND	$V_{LC}$	V
		$V_{CC} = \text{Min.}$	$I_{OL} = 300mA$	—	GND	$V_{LC}$	
		$V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OL} = 64mA$	—	0.3	0.55	
$V_H$	Input Hysteresis for all inputs	—	—	200	—	mV	
$I_{CC}$	Quiescent Power Supply Current	$V_{CC} = \text{Max.}$ , $V_{IN} = \text{GND}$ or $V_{CC}$	—	5	500	$\mu A$	

### NOTES:

1. For conditions shown as Max. or Min., use appropriate value specified under Electrical Characteristics for the applicable device type.
2. Typical values are at  $V_{CC} = 5V$ ,  $+25^\circ C$  ambient.
3. Not more than one output should be shorted at one time. Duration of the test should not exceed one second.

## POWER SUPPLY CHARACTERISTICS

Symbol	Parameter	Test Conditions <sup>(1)</sup>		Min.	Typ. <sup>(2)</sup>	Max.	Unit
$\Delta I_{CC}$	Quiescent Power Supply Current TTL Inputs HIGH	V <sub>CC</sub> = Max. V <sub>IN</sub> = 3.4V <sup>(3)</sup>		—	1	2.5	mA
I <sub>CCD</sub>	Dynamic Power Supply Current <sup>(4)</sup>	V <sub>CC</sub> = Max. Outputs Open OEA = OEB = GND 50% Duty Cycle	V <sub>IN</sub> = V <sub>CC</sub> V <sub>IN</sub> = GND	—	0.15	0.2	mA/MHz
I <sub>C</sub>	Total Power Supply Current <sup>(6)</sup>	V <sub>CC</sub> = Max. Outputs Open f <sub>o</sub> = 10MHz 50% Duty Cycle OEA = OEB = V <sub>CC</sub> Mon. Output Toggling	V <sub>IN</sub> = V <sub>CC</sub> V <sub>IN</sub> = GND	—	1.5	2.5	mA
			V <sub>IN</sub> = 3.4V V <sub>IN</sub> = GND	—	2	3.8	
		V <sub>CC</sub> = Max. Outputs Open f <sub>o</sub> = 2.5MHz 50% Duty Cycle OEA = OEB = GND Eleven Outputs Toggling	V <sub>IN</sub> = V <sub>CC</sub> V <sub>IN</sub> = GND	—	4.1	6 <sup>(5)</sup>	
			V <sub>IN</sub> = 3.4V V <sub>IN</sub> = GND	—	5.1	8.5 <sup>(5)</sup>	

### NOTES:

- For conditions shown as Max. or Min., use appropriate value specified under Electrical Characteristics for the applicable device type.
- Typical values are at V<sub>CC</sub> = 5V, +25°C ambient.
- Per TTL driven input (V<sub>IN</sub> = 3.4V); all other inputs at V<sub>CC</sub> or GND.
- This parameter is not directly testable, but is derived for use in Total Power Supply calculations.
- Values for these conditions are examples of the I<sub>C</sub> formula. These limits are guaranteed but not tested.
- I<sub>C</sub> = I<sub>QUIESCENT</sub> + I<sub>INPUTS</sub> + I<sub>DYNAMIC</sub>  
 $I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD} (f_o N_o)$   
 I<sub>CC</sub> = Quiescent Current (I<sub>CC1</sub>, I<sub>CC2</sub> and I<sub>CC3</sub>)  
 $\Delta I_{CC}$  = Power Supply Current for a TTL High Input (V<sub>IN</sub> = 3.4V)  
 D<sub>H</sub> = Duty Cycle for TTL Inputs High  
 N<sub>T</sub> = Number of TTL Inputs at D<sub>H</sub>  
 I<sub>CCD</sub> = Dynamic Current Caused by an Input Transition Pair (HLH or LHL)  
 f<sub>o</sub> = Output Frequency  
 N<sub>o</sub> = Number of Outputs at f<sub>o</sub>  
 All currents are in milliamps and all frequencies are in megahertz.

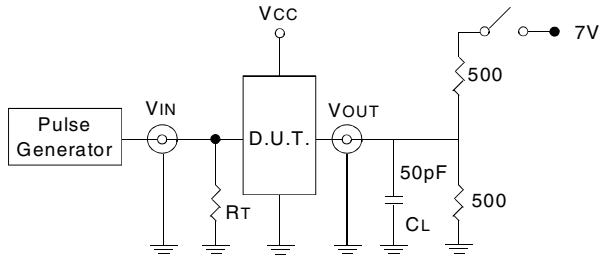
SWITCHING CHARACTERISTICS OVER OPERATING RANGE<sup>(1)</sup>

Symbol	Parameter	Conditions <sup>(2)</sup>	FCT805		FCT805A		Unit
			Min.	Max.	Min.	Max.	
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay INA to OAn, INB to OBn	CL = 50pF RL = 500Ω	1.5	5.6	1.5	5.3	ns
t <sub>R</sub>	Output Rise Time		—	1.5	—	1.5	ns
t <sub>F</sub>	Output Fall Time		—	1.5	—	1.5	ns
t <sub>SK(O)</sub>	Output skew: skew between outputs of all banks of same package (inputs tied together)		—	0.7	—	0.7	ns
t <sub>SK(P)</sub>	Pulse skew: skew between opposite transitions of same output ( t <sub>PHL</sub> - t <sub>PLH</sub>  )		—	1	—	1	ns
t <sub>SK(PP)</sub>	Part-to-part skew: skew between outputs of different packages at same power supply voltage, temperature, package type and speed grade		—	1.5	—	1.5	ns
t <sub>PZL</sub> t <sub>PZH</sub>	Output Enable Time OEA to OAn, OEB to OBn		1.5	8	1.5	8	ns
t <sub>PLZ</sub> t <sub>PHZ</sub>	Output Disable Time OEA to OAn, OEB to OBn		1.5	7	1.5	7	ns

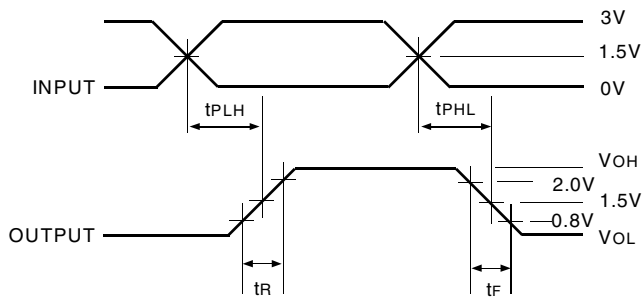
NOTES:

1. Propagation delay range indicated by Min. and Max. limit is due to V<sub>cc</sub>, operating temperature and process parameters. These propagation delay limits do not imply skew.
2. See test circuits and waveforms.

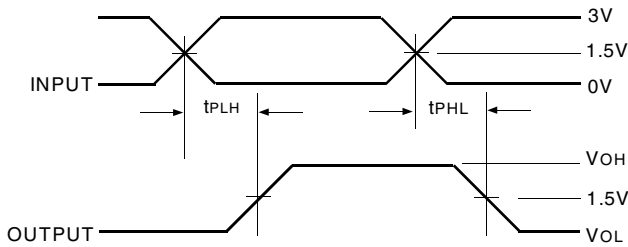
## TEST CIRCUITS AND WAVEFORMS



Test Circuits for All Outputs

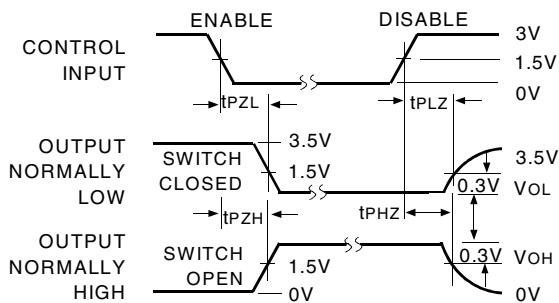


Package Delay



$$t_{SK(P)} = |t_{PHL} - t_{PLH}|$$

Pulse Skew -  $t_{SK(P)}$



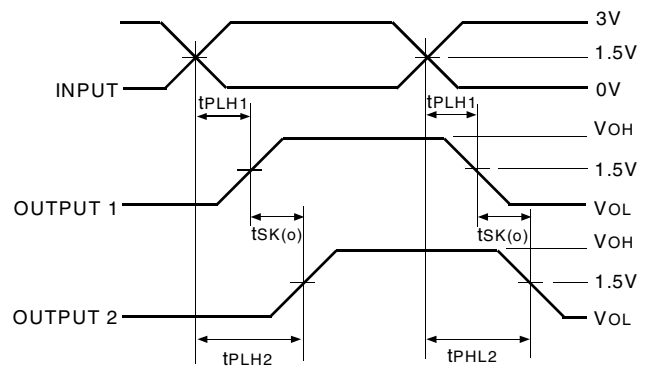
Enable and Disable Times

## SWITCH POSITION

Test	Switch
Disable LOW Enable LOW	Closed
Disable HIGH Enable HIGH	GND

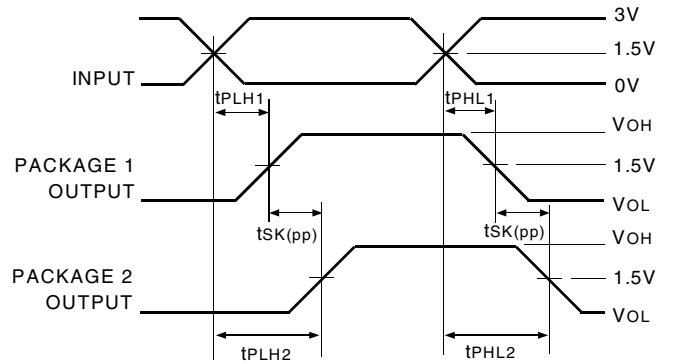
### DEFINITIONS:

CL = Load capacitance: includes jig and probe capacitance.  
RT = Termination resistance: should be equal to Zout of the Pulse Generator.



$$t_{SK(o)} = |t_{PLH2} - t_{PLH1}| \text{ or } |t_{PHL2} - t_{PHL1}|$$

Output Skew



$$t_{SK(pp)} = |t_{PLH2} - t_{PLH1}| \text{ or } |t_{PHL2} - t_{PHL1}|$$

Part-to-Part Skew -  $t_{SK(PP)}$

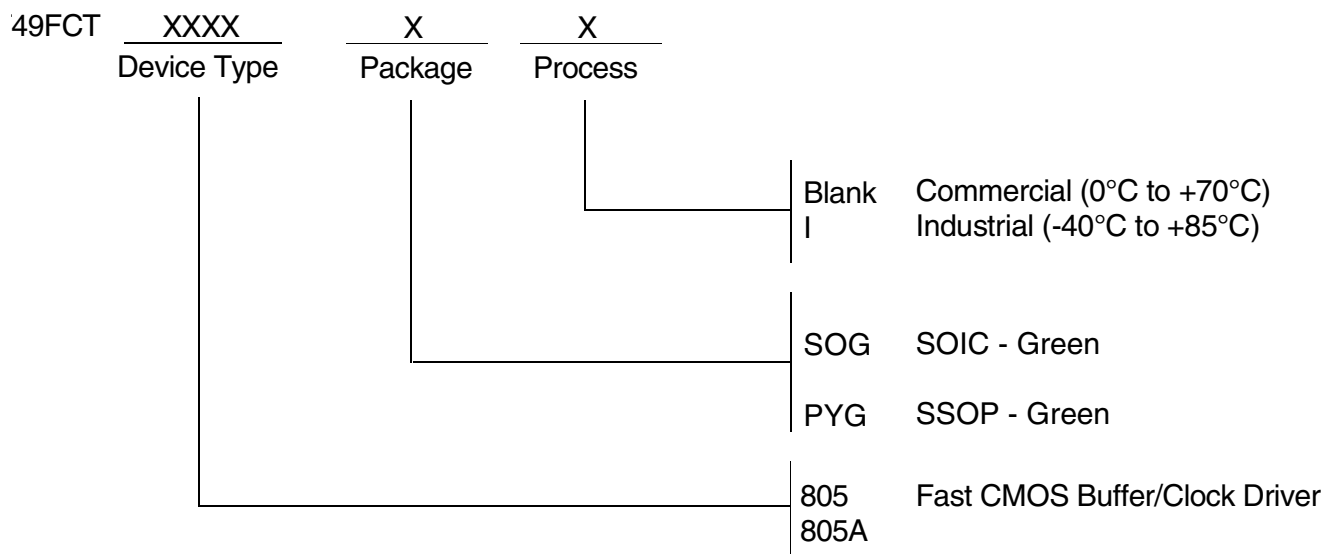
### NOTE:

1. Package 1 and Package 2 are same device type and speed grade.

### NOTES:

1. Diagram shown for input Control Enable-LOW and input Control Disable-HIGH
2. Pulse Generator for All Pulses: Rate  $\leq 1.0\text{MHz}$ ;  $t_r \leq 2.5\text{ns}$ ;  $t_f \leq 2.5\text{ns}$

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